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*ORCONECTES ETNIERI*, A NEW SPECIES OF CRAYFISH  
FROM WESTERN TENNESSEE AND NORTHERN  
MISSISSIPPI WITH NOTES ON *PROCAMBARUS*  
*ABLUSUS* AND *ORCONECTES WRIGHTI*

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This new species of crayfish is known from the Mississippi Embayment province of Tennessee in the Tennessee, Forked Deer, Hatchie and Loosahatchie River systems where it is one of the more common species. In many western Tennessee collections from fluvial environments, it was the only species represented. Two of its associates, *Procambarus* (*Pennides*) *ablusus* Penn (1963:121) and *Orconectes wrighti* Hobbs (1948:85), are known from only a few specimens. *Procambarus ablusus* was described on the basis of 7 specimens (4 adults) from 5 localities in Mississippi and Tennessee. Until recently, *O. wrighti* was known from only 11 specimens collected at the type-locality. Large populations of *P. ablusus* are more common in the Forked Deer River system, while *O. wrighti* occurs in an additional larger downstream tributary (see below) of the Tennessee River.

***Orconectes etnieri*, new species**

Figure 1a-k

*Orconectes immunis*.—Penn, 1963:125.

**Diagnosis:** Body and eyes with pigment. Rostrum without marginal tubercles (may be present on juveniles). Areola 4.2 to 7.2 times longer than broad, constituting 26.3 to 30.3 percent of total length of carapace (35.4 to 39.4 percent of postorbital carapace length) with 2 to 4 punctations across narrowest part. Single cervical spine present on each side of carapace. Hepatic spines absent; branchiostegal spine small and

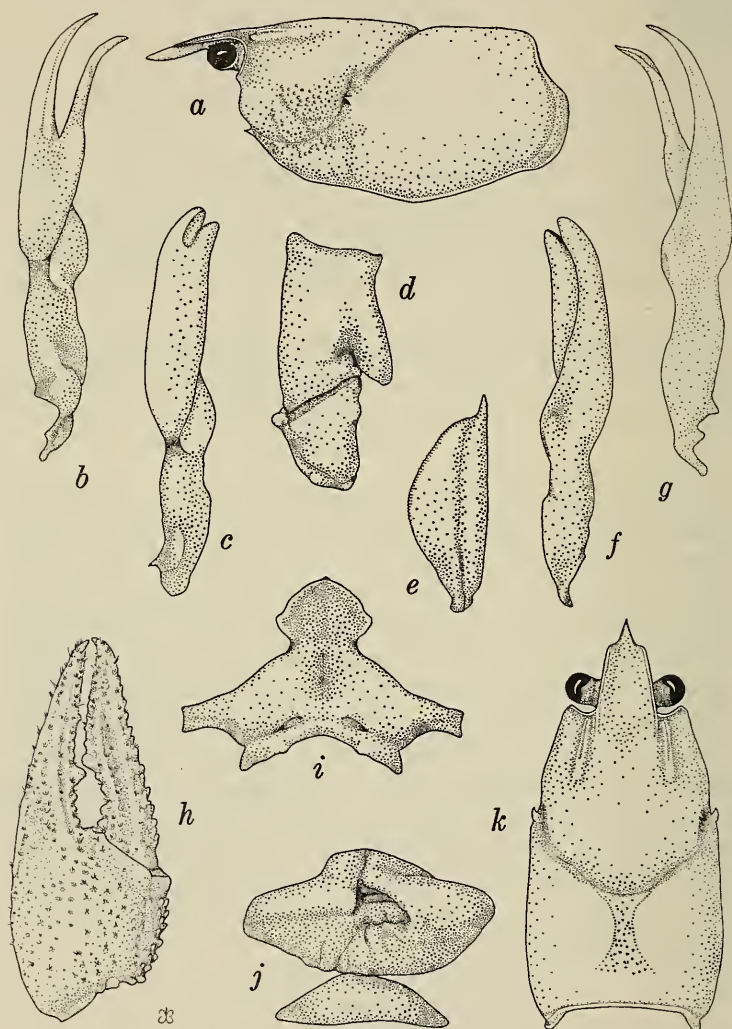


FIG. 1. *Orconectes etnieri*, new species. *a*, Lateral view of carapace of holotype; *b*, Mesial view of first pleopod of holotype; *c*, Mesial view of first pleopod of morphotypic male; *d*, Basipodite and ischiopodite of third pereiopod of holotype; *e*, Antennal scale of paratopotypic male, form I; *f*, Lateral view of first pleopod of morphotypic male; *g*, Lateral view of first pleopod of holotype; *h*, Dorsal view of chela of holotype; *i*, Epistome of holotype; *j*, Annulus ventralis of allotype; *k*, Dorsal view of carapace of holotype.

acute. Suborbital angle poorly developed, terminating cephalically in acute, corneous-tipped spine. Antennal scale longer than broad, broadest slightly distal to midlength; lamellar portion with 3 sided margin. Chela with two subserrate rows of tubercles along mesial margin of palm; scattered smaller tubercles over dorsomesial half of palm; small setal tufts over entire dorsal surface; lateral base of fixed finger impressed; well defined longitudinal ridges on dorsal surfaces of fingers. Hook on ischium of third pereopod of first form male overreaching basioischial articulation. First pleopod of first form male with central projection corneous, tapering and reaching basis of second pair of pereopods when abdomen flexed; mesial process shorter, non-corneous with distal end flared into shallow trough; distal ends of both elements curved caudally at same angle to shaft of appendage (see Fig. 1*b*, *g*).

*Holotypic male, form 1:* Body subovate, somewhat depressed (Fig. 1*a*, *k*). Abdomen narrower than thorax (14.0 and 17.0 mm). Greatest width of carapace greater than depth at caudodorsal margin of cervical groove (17.0 and 14.0 mm). Areola 6.0 times longer than broad with 3 punctations across narrowest part; length of areola 28.8 percent of entire length of carapace (37.8 percent of postorbital carapace length). Rostrum with thickened, straight, subparallel margins devoid of marginal spines or tubercles. Acumen with concave, slender, margins, terminating in very small upturned, corneous tubercle, latter reaching end of antennular peduncle. Rostrum comparatively flat dorsally with slight impression basally; low, broad carina evident along flattened portion. Rostrum with submarginal punctations dorsally, others scattered between. Postorbital ridge moderately developed, shallowly grooved dorsolaterally and terminating cephalically in acute, corneous tubercle. Suborbital angle poorly developed and obtuse; branchiostegal spine small and acute. Single acute cervical spine on each side of carapace. Hepatic area and lateral portion of branchiostegite tuberculate; dorsal surface of carapace punctate.

Abdomen longer than carapace (35.2 and 31.3 mm); pleura of moderate length with caudoventral extremities subangular. Cephalic section of telson with marginal immovable spine and submarginal movable one in each caudolateral corner; partially separated from caudal section by 2 oblique incisions. Basal podomere of uropod with spine extending over lateral and mesial rami. Lateral ramus of uropod with median and submesial ridges, former terminating in acute spine at transverse flexure. Proximal portion of lateral ramus with row of spines distally and large movable spine submarginally at caudolateral corner (broken on right side). Mesial ramus of uropod with median ridge terminating distally in acute premarginal spine (missing on right side). Dorsal surface of telson and uropods lightly setiferous.

Cephalic lobe of epistome (Fig. 1*i*) spatulate with thickened, irregular cephalolateral margins, and lacking cephalomedian projection. Main body of epistome with very shallow median fovea and pair of obliquely disposed slitlike fossae immediately cephalic and subparallel to thickened,

arched epistomal zygoma. Proximal segment of antennule with small spine on ventral surface near midlength. Antennae broken. Antennal scale (Fig. 1e) broadest at at midlength with 3 sided margin on lamellar portion; thickened lateral portion terminating in prominent, acute, corneous-tipped spine reaching distal end of antennular peduncle.

Left chela (Fig. 1h) with mesial margin of palm possessing primary subserrate row of 8 tubercles and secondary row of 6 smaller ones on dorsal surface lateral to primary row; scattered tubercles over dorso-mesial half of palm; distoventral surface of palm with 2 tubercles at base of dactyl; dorsal surface covered with numerous small setal tufts. Lateral surface of propodus costate with row of punctations rendering proximolateral base of finger impressed dorsally and less so ventrally; dorsal and ventral surfaces with distinct submedian ridges flanked by setiferous punctations; opposable surface with row of 10 tubercles along proximal two-thirds of finger, fourth from base largest; additional tubercle present on lower level near base of distal third; double row of minute denticles extending proximally from distal end of third tubercle, interrupted by fourth through tenth tubercles. Dorsal and ventral surfaces of dactyl with median longitudinal ridges flanked by setiferous punctations; opposable margin with row of 16 tubercles, fifth largest; double row of denticles extending proximally from distal end to fifth tubercle, interrupted by each of sixth through sixteenth tubercles; mesial surface with irregular rows of tubercles on proximal two-thirds, reduced to single row distally. Fingers with distal tubercles very small and inconspicuous; terminating in large, acute, corneous tips.

Carpus with deep oblique furrow dorsally; mesial surface with large procurved spine near midlength, 9 and 10 scattered tubercles on left and right cheliped, respectively; dorsal surface with 9 tubercles (right with 12) and additional acute one at distomesial margin; distoventral margin with 2 acute tubercles (median one on left broken); podomere otherwise punctate.

Dorsodistal surface of left merus with 2 acute to subacute tubercles (right with 3); ventral surface with lateral row of 2 corneous-tipped spines, proximal one smaller, and mesial row of 9 spines, some corneous, decreasing in size proximally. Ischium with single small corneous-tipped tubercle on ventromesial margin.

Hook on ischium of third pereopod only (Fig. 1d); hook simple, overreaching basioischial articulation and not opposed by tubercle on basis. Coxae of fourth and fifth pereopods without caudomesial boss. (See *Measurements*.)

First pleopods (Fig. 1b, g) reaching bases of second pair of pereopods when abdomen flexed. (See *Diagnosis* for description.)

*Allotypic female*: Differing from holotype in following respects: areola constituting 28.7 percent of entire length of carapace (37.8 percent of postorbital carapace length) and 5.7 times longer than broad. Postorbital ridges terminating in more acute spines. Left chela (right missing) distinctly narrower and shorter with mesial surface of palm



bearing 7 tubercles in primary and 4 in secondary rows. Propodus with opposable margin bearing row of 9 tubercles, fifth from base largest; additional tubercle present on lower level; double row of denticles extending proximally from distal tip to fifth tubercle, interrupted by sixth through eleventh. Dactyl with opposable margin bearing 11 tubercles, first and fourth from base largest; double row of denticles extending proximally from tip to fifth tubercle, interrupted by sixth through eleventh. Carpus of left cheliped with mesial surface possessing corneous-tipped, procurved spine; distoventral margin with 2 corneous-tipped spines. Left merus with ventral surface bearing mesial row of 10 spines, some corneous-tipped.

Sternum between third and fourth pereopods broadly V-shaped. Annulus ventralis (Fig. 1j) symmetrical and firmly fused cephalically to sternum; cephalic portion elevated with shallow, longitudinal, median trough flanked by low ridges, latter produced laterally at midlength as transverse, elevated ridges; fossa centrally located; caudal half bearing ?-shaped sinistral sinus. Postannular sclerite about two-thirds as wide as annulus. First pleopods of female uniramous and reaching midlength of annulus when abdomen flexed.

*Morphotypic male, form II:* Differing from holotype in following respects: areola constituting 28.9 percent of entire length of carapace (39.7 percent of postorbital carapace length), and 7.2 times longer than broad with 2 punctations across narrowest part. Postorbital ridge with more acute spine cephalically. Mesial surface of palm of right chela (left regenerated) with 7 tubercles in primary and 4 in secondary rows; propodus bearing 11 tubercles on opposable margin, additional one on lower level. Dactyl with opposable margin possessing 15 tubercles; double row of denticles extending proximally from tip to third tubercle, interrupted by fourth through fifteenth. Carpus of right cheliped with mesial surface bearing corneous-tipped, procurved spine and 12 scattered tubercles. Merus with single corneous-tipped tubercle representing usual ventrolateral row. Right ischium with single non-cornified tubercle on ventromesial margin.

Hook on ischium of third pereopod much reduced, not overreaching basioischial articulation. First pleopod (Fig. 1c, f) of uniform texture, subequal and neither element corneous. Distal ends of both elements recurved at angle of approximately 40 degrees.

*Type-locality:* Robinson Creek at Tennessee State Highway 57 (Tennessee River system), Hardin County, Tennessee. The creek varies from 6 to 15 feet in width and as much as 3 feet in depth in pools and less than 1 foot at the riffles. During several visits to the creek, the water ranged from clear to slightly turbid. The substrate is mostly sand with gravel in the riffles, several small to moderately sized rocks below the bridge site and numerous pockets of leaf litter in the pools and around obstructions in the runs. Mixed deciduous trees line the banks of this small creek. Robinson Creek is also the type-locality for *Orconectes wrighti* Hobbs (1948).

*Disposition of types:* The holotypic male, form I (USNM 146583), the allotype (USNM 146584) and the morphotypic male, form II (USNM 146585) are deposited in the National Museum of Natural History, Smithsonian Institution. Paratypes consisting of 8 ♂ I, 6 ♂ II, 9 ♀, 3 ♂ juv. and 11 ♀ juv. are in the Smithsonian Institution; 2 ♂ I and 2 ♀ are deposited in the Tulane University Museum; and 8 ♂ I, 16 ♂ II, 19 ♀, 2 ♀ eggs, 1 ♂ juv. and 4 ♀ juv. are in the collection of the senior author.

*Range and specimens examined:* This new species of crayfish is known from Tennessee and Mississippi. In Tennessee *Orconectes etnieri* has been collected from tributaries draining the west bank of the Tennessee River from Robinson Creek northward to Snake Creek in Hardin and McNairy counties. In waters flowing westward into the Mississippi River, it has been collected from the Forked Deer, Hatchie and Loosahatchie River systems in Tennessee and Mississippi. A crayfish of the Mississippi Embayment province, it is absent from the sluggish waters that characterize the Mississippi River Floodplain section.

The following material is designated as paratypes: TENNESSEE. HARDEMAN COUNTY. Dry Branch at Tennessee State Highway 125, 1.3 miles south of intersection with U.S. Highway 64 (Hatchie River system via Spring Creek). C. E. Comiskey, D. A. Etnier and M. Reese. 18 October 1968. 6 ♂ I, 3 ♀. HARDIN COUNTY. Robinson Creek at Tennessee State Highway 57 and two additional localities approximately 0.7 and 1.2 air miles upstream (Tennessee River system). P. Yokley, Jr., and R. W. B. 15 March 1971. 5 ♂ I, 6 ♂ II, 6 ♀, 1 ♀ eggs, 1 ♂ juv. and 4 ♀ juv.; Robinson Creek at Tennessee State Highway 57 and single additional locality approximately 0.7 air miles upstream. J. D. Way and R. W. B. 14 March 1972. 2 ♂ I, 7 ♂ II, 10 ♀, 2 ♂ juv. and 6 ♀ juv.; Snake Creek at Tennessee State Highway 22 (Tennessee River system). C. E. Comiskey, D. A. Etnier and M. Reese. 19 October 1968. 2 ♂ I and 2 ♀. MCNAIRY COUNTY. Snake Creek, at County Road 8235, 2.0 miles west of intersection with County Road 8083. T. Carson, B. Clark, M. Hughes and G. A. Schuster. 1 March 1974. 3 ♂ I, 10 ♂ II, 13 ♀ and 1 ♀ eggs.

*Variation:* The most significant variation within the species occurs in the annulus ventralis. The anterior ridges bordering the median trough of the annulus may be lacking, and in some populations the trough is broader and more deeply excavated.

*Size:* The largest specimen available is a second form male with a total carapace length of 32.5 mm (postorbital carapace length 24.0 mm). The smallest first form male has corresponding lengths of 18.4 and 13.9 mm. The smaller of the two females with eggs has a total carapace length of 24.6 mm. (postorbital carapace length 18.6 mm).

*Color notes:* Cephalothorax and abdomen mottled with browns and a pair of dorsolateral and submedian broken, dark brown stripes on abdomen extending onto cephalothorax as darker mottled dorsolateral areas. Stripes and dark dorsolateral mottling may be less obvious and faded in some individuals. Branchiostegites and hepatic region otherwise light

TABLE 1. Measurements (mm) of *Orconectes etnieri*

	Holotype	Allotype	Morphotype
Carapace			
Height	14.0	12.7	13.4
Width	17.0	13.9	15.6
Total length of carapace	31.3	29.6	32.5
Postorbital carapace length	23.8	22.5	24.0
Areola			
Width	1.5	1.5	1.3
Length	9.0	8.5	9.4
Rostrum			
Width	4.5	3.2	4.3
Length	7.5	7.1	8.5
Chela			
Length, mesial margin palm	9.2	6.0	8.6
Width, palm	12.6	7.2	10.1
Length, lateral margin	30.2	18.8	26.5
Length, dactyl	18.7	11.0	15.9

brown to white. Rostral margins, postorbital ridges and lateral margins of antennal scales darker brown than basic color of body. Ventral aspects of cephalothorax and abdomen white.

Chelae mottled to concolorous brown dorsally with lighter proximolateral area; white to cream ventrally. Tubercles along opposable margins of fingers yellow to cream. Distal ends of fingers red in young, often orange or yellow in adults. Pereiopods mottled brown dorsally; fading to cream or white ventrally. Distal podomeres darker dorsally than proximal ones.

*Life history notes:* First form males have been collected during the months of March, July and October. Two females bearing eggs were collected, one each on 15 March 1971 and 1 March 1974.

*Ecological notes:* *Orconectes etnieri* commonly inhabits the leaf litter which has collected in pools or above obstructions, such as fallen branches, in the runs. At the type-locality *O. etnieri* shared its preferred habitat with *Procambarus acutus acutus* (Girard 1852), *P. ablusus*, *Orconectes validus* (Faxon 1914), *O. wrighti*, *Cambarus striatus* Hay (1902) and occasional individuals of the primary burrowing crayfish *C. diogenes* Girard (1852). *Orconectes wrighti* was more common under rocks that littered the riffles. *Cambarus striatus* and *Cambarus diogenes* were common burrowers in the stream bank.

Collected along with *Orconectes etnieri* in one or more localities were *Procambarus ablusus* (Hatchie, Forked Deer and Tennessee River sys-

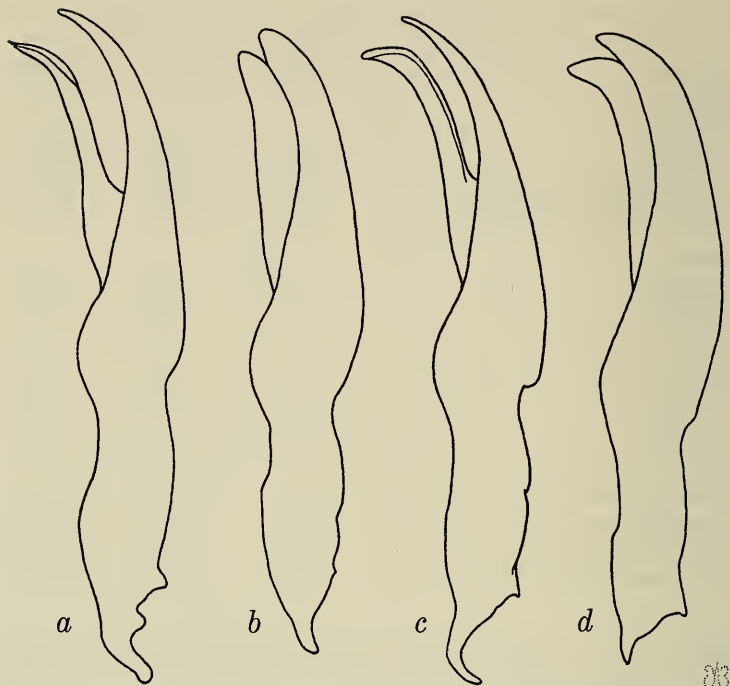


FIG. 2. Lateral view of left first pleopods of two species of *Orconectes*. *a*, First form male, *O. etnieri*; *b*, Second form male, *O. etnieri*; *c*, First form male, *O. validus*; *d*, Second form male, *O. validus*.

tems), *P. a. acutus* (Tennessee River system), *Cambarus striatus* (Hatchie, Forked Deer, Loosahatchie and Tennessee River systems), *Cambarus diogenes* (Hatchie and Tennessee River systems), *Orconectes p. palmeri* (Faxon 1884) (Loosahatchie River system), *O. placidus* (Hagen 1870), *O. validus* and *O. wrighti* (Tennessee River system).

When *Procambarus ablusus* was described from the Hatchie River system in Mississippi and Tennessee, it was regarded by Penn as an uncommon species and remains so in museum collections. *Procambarus ablusus* does appear to be rare in the Hatchie River system but in some localities in the Forked Deer River basin to the north it is very common.

*Orconectes wrighti* is also a little known crayfish with an apparently restricted range. In addition to its presence in the type-locality, a population of this rare species occurs in a stream flowing through Hardin and McNairy counties, Snake Creek, a tributary of the Tennessee River. Its range probably does not exceed the area bordered by these two localities and it may not occur outside of the two creek systems.



*Relationships:* *Orconectes etnieri* has its closest affinities with *O. validus* from which it differs primarily in the morphology of the male gonopod. In *O. etnieri* the terminal elements are recurved at the same angle (Fig. 2a, b) while in *O. validus* the angles differ, with the mesial process recurved at approximately 90 degrees (Fig. 2c, d). The rostrum of *O. etnieri* is much flatter in comparison to the deeply excavate one of *O. validus*. For the most part the two species occupy mutually exclusive ranges. *Orconectes validus* occurs in the Tennessee River system in streams draining the Highland Rim section downstream to Benton County, Tennessee. A single female from Montgomery County, Tennessee, (Cumberland River system) may also be a member of this species possibly indicating a larger range. *Orconectes etnieri* is known from only a small part of the Tennessee River system in Hardin and McNairy counties, Tennessee, (Robinson Creek and Snake Creek) and very possibly occurs in nearby tributaries of the Tennessee River in Mississippi. Most of the range of *O. etnieri*, however, embraces westward flowing tributaries of the Mississippi River from which *O. validus* is absent. Both species were collected syntopically at the type-locality.

*Etymology:* We take great pleasure in naming this new species of crayfish in honor of David A. Etnier, University of Tennessee, Knoxville, for his many contributions to our knowledge of Tennessee crayfishes and especially his enthusiasm in collecting primary burrowing species.

*Acknowledgments:* We are indebted to Joseph F. Fitzpatrick, Jr., University of South Alabama, Mobile, who with Horton H. Hobbs, Jr., originally noted the uniqueness of this new species and permitted us the honor of naming it after our former major professor. To Horton H. Hobbs, Jr., we are as always indebted for his kindness and valuable assistance and for reviewing the manuscript. To David A. Etnier and his students who helped collect much of the material upon which this description is based we owe thanks, especially to those who surveyed the West Tennessee fish fauna: George Boronow (Forked Deer River system), Byron Clark (Tennessee River system), William Dickinson (Obion River system) and Wayne Starnes (Hatchie River system). Appreciation is extended to the Smithsonian Institution for providing the senior author with a Smithsonian Postdoctoral Fellowship permitting the opportunity to describe this new species.

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